Low Cost, Vacuum Packaging of GN&C Sensors, Phase I

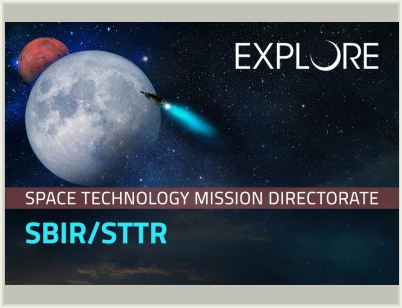
Completed Technology Project (2004 - 2005)

Project Introduction

Micro-electro-mechanical System (MEMS)-based gyroscopes, accelerometers and rate sensors are essential to miniaturizing the guidance, navigation and control electronics of satellite systems. Wafer level packaging is the preferred method of sealing MEMS devices to achieve low cost. However, devices are currently housed in expensive hermetic packages. In the case of gyros, high vacuum levels need to be created and maintained to achieve high Q values. Current hybrid hermetic packages are expensive, heavy and bulky. Although there is considerable activity in developing wafer level sealing techniques, there is currently no universal approach to seal MEMS devices at the wafer level. SiWave proposes to develop a universal wafer level sealing technology that: does not require processing of the device wafer, achieves room temperature sealing enabling encapsulation of sensitive devices and provides for an evaporable getter to maintain a high vacuum over the life of the package. SiWave will package a very high accuracy, absolute pressure sensor to demonstrate the concept as well as to quantify the effectiveness of the proposed approach. Once sealed at the wafer level, the device can be singulated and packaged using conventional plastic packaging techniques or housed in a low cost, plastic enclosure depending on the application.

Anticipated Benefits

With the explosion of wireless medications across the globe, the need for RF devices such as T/R modules, SAWs, and MEMS RF switches is escalating as never before. The technology proposed here will provide high-performance hermetic encapsulation of the devices at the low costs achieved through batch processing and wafer level packaging. Applications include wireless pressure sensors for the automotive industry, SAWs for cell phone, RF Datacom, and radio communications, and optical communications. Also, it is estimated that the inertial sensor market is around $0.7-1.4 Billion/year, pressure sensor market is about $1-2.5 Billion/year and market for other sensors around $1.2-2.5 Billion/year. This development will allow the realization of low cost, miniaturized GN&C sensors for microsats and conventional satellites. Commercial and space satellite systems requires many sensors for GN&C and packaging remains the last hurdle in benefiting from the numerous technical advancements in the sensor technology. This program will eliminate this hurdle.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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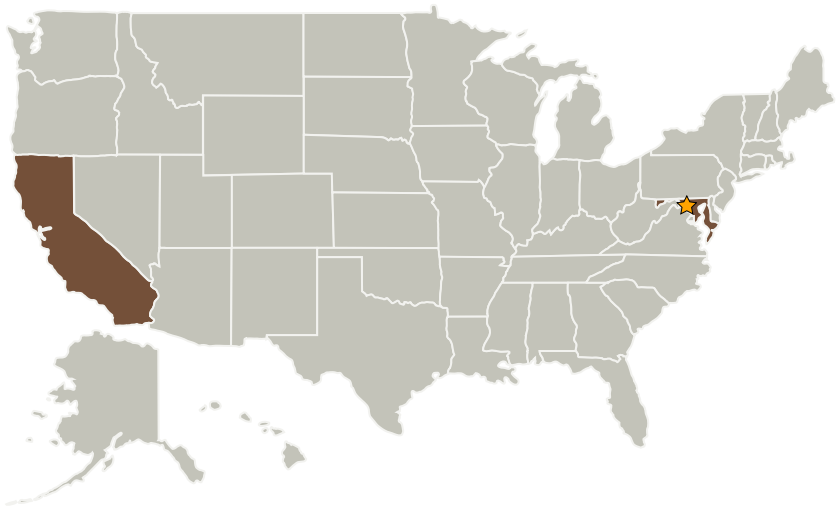
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Siwave, Inc.	Supporting Organization	Industry	Arcadia, California

Primary U.S. Work Locations	
California	Maryland

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Managers:

Neil Dennehy
Terrence W Wilcutt

Principal Investigators:

Richard S Williams
Kumaraswamy Jayaraj

Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.2 Navigation Technologies
    - TX17.2.3 Navigation Sensors